

Claims

1. A system having a microfluidic channel structure in which fluids are able to interact to produce at least one product, and an automated closed-loop control mechanism to autonomously control a condition in, or of, the channel structure, the control mechanism having:-

10 a sensor adapted to produce a sensor signal representative of a predetermined property of the at least one product which is dependent on the condition in, or of, the channel structure,

means adapted to vary the condition in, or of, the channel structure, and

15 a computer adapted to receive the sensor signal and to cause the means to vary the condition in, or of, the channel structure in dependence of the sensor signal.

20 2. The system of claim 1, wherein the sensor is adapted to produce a sensor signal representative of a predetermined chemical property of the at least one product.

25 3. The system of claim 1, wherein the sensor is adapted to produce a sensor signal representative of a predetermined biological property of the at least one product.

4. The system of any one of the preceding claims, wherein the means is adapted to vary a physical condition in, or of, the channel structure.

5 5. The system of any one of the preceding claims having a transfer mechanism to transfer reagents from an array of reagents to the channel structure.

6. The system of claim 5 in which the operation of
10 the transfer mechanism is controlled by the computer.

7. The system of claim 5 or 6 further including the reagent array.

15 8. The system of claim 5, 6 or 7, wherein the means to vary the condition in the channel structure is the transfer mechanism, the computer being adapted to cause the transfer mechanism to change the reagent combination in the channel structure in dependence of
20 the sensor signal.

9. The system of any one of claims 1 to 8, wherein the channel structure has a flow channel and more than two inlets thereto, at least one inlet being located
25 downstream of one of the other inlets, and the means to vary is adapted to be controlled by the computer to vary the sequence and/or timing and/or point of introduction of fluids into the channel through the inlets in dependence of the sensor signal.

10. The system of any one of the preceding claims whose operation is fully automated.

11. The system of any one of the preceding claims,
5 wherein the computer is programmed to operate the control mechanism to produce a product of which the predetermined property satisfies a predetermined objective.

10 12. The system of claim 11, wherein the predetermined property is a chemical property and/or a physical property and/or a biological property.

15 13. The system of any one of the preceding claims provided that the control mechanism is not adapted to control a condition in the channel structure to provide an optimised yield of a product.

20 14. The system of claim 11, wherein the predetermined property is a chemical property and the predetermined objective relates to identity, purity, conversion, isomeric ratio, yield, impurity profile or colour.

25 15. The system of claim 11, wherein the predetermined property is a biological property and the predetermined objective relates to activity, potency, selectivity or duration.

16. The system of any one of the preceding claims, wherein the control mechanism is adapted to control a condition of the channel structure.

5 17. The system of claim 16, wherein the condition of the channel structure is the geometry thereof.

18. The system of any one of the preceding claims which is an integrated, computer-controlled system.

10

19. A method of screening of chemical compounds implemented on the system of any one of claims 1 to 18.

15

20. The method of claim 19 when appended to claim 11 comprising the steps of providing an array of chemical compounds and programming the computer to operate the closed-loop control mechanism to autonomously run different combinations of the compounds through the microfluidic channel structure until a compound combination results in a product having a predetermined biological property which satisfies a predetermined objective.

25 21. The method of claim 20 in which the compound array is categorised.

22. The method of claim 19 or 20 in which the computer operates the control mechanism heuristically.

30

23

23. A method of optimising a predetermined property of a product implemented on the system of any one of claims 1 to 18.